MULTIMEDIA UNIVERSITY

STUDENT ID NO

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 3, 2018/2019**

## BPO2614 – PRODUCTION & OPERATIONS MANAGEMENT

(All sections / Groups)

27 MAY 2019

9 a.m. – 12 p.m.

(3 Hours)

---

**INSTRUCTIONS TO STUDENTS**

1. This question paper consists of **SEVEN (7)** pages (including the cover page).

2. Answer **ALL** questions. The marks distributions are given in parentheses.

3. Write all your answers in the **Answer Booklet** provided.

## QUESTION 1

(a) Charles Lackey operates a bakery in Idaho Falls, Idaho. Because of its excellent product and excellent location, demand has increased by 25% in the last year. On far too many occasions, customers have not been able to purchase the bread of their choice. Because of the size of the store, no new ovens can be added. At a staff meeting, one employee suggested ways to load the ovens differently so that more loaves of bread can be baked at one time. This new process will require that the ovens be loaded by hand, requiring additional manpower. This is the only thing to be changed. If the bakery makes 1,500 loaves per month with a labor productivity of 2.344 loaves per labor-hour, how many workers will Lackey need to add? (Hint: Each worker works 160 hours per month.)

[6 Marks]

(b) A company manufactures high quality electronic components for industrial and military potentiometers. One particular component has reached maturity, and the company is considering whether to replace it with a newer model. Technologies have not changed dramatically, so the new component would have similar functionality to the existing one, but would be smaller and lighter in weight. The firm's three choices are: (1) keep the old model, (2) design a replacement component with internal resources, (3) and purchase a new design from a firm that is one of its suppliers. The market for these components will be either "receptive" or "neutral" of the replacement model. The financial estimates are as follows: Keeping the old design will yield a profit of $6 million dollars. Designing the replacement internally will yield $10 million if the market is "receptive," but a $3 million loss if the market is "neutral." Acquiring the new design from the supplier will profit $4 million under "receptive," $1 million under "neutral." The company feels that the market has a 70 percent chance of being "receptive" and a 30 percent chance of being "neutral."

Required:

(i) Draw the appropriate decision tree.

[4 Marks]

(ii) Calculate the expected value for all courses of action.

[6 Marks]

(iii) What action yields the highest expected value?

[4 Marks]

**Continued...**

## QUESTION 2

(a) A restaurant has tracked the number of meals served at lunch over the last four weeks. The data show little in terms of trends, but do display substantial variation by day of the week. Use the following information to determine the seasonal (daily) indices for this restaurant.

| | Week | | | |
|---|---|---|---|---|
| Day | 1 | 2 | 3 | 4 |
| Sunday | 40 | 35 | 39 | 43 |
| Monday | 54 | 55 | 51 | 59 |
| Tuesday | 61 | 60 | 65 | 64 |
| Wednesday | 72 | 77 | 78 | 69 |
| Thursday | 89 | 80 | 81 | 79 |
| Friday | 91 | 90 | 99 | 95 |
| Saturday | 80 | 82 | 81 | 83 |

[14 Marks]

(b) What type of forecasting method would you recommended to a start-up retailer in terms of quantity and number of products? Would you use the same method after, say, five years of operation? Explain

[6 Marks]

## QUESTION 3

Read the following case and answer the given questions.

**Case Study: Zhou Bicycle Company**

Zhou Bicycle Company (ZBC), located in Seattle, is a wholesale distributor of bicycles and bicycle parts. Formed in 1981 by University of Washington Professor Yong-Pin Zhou, the firm's primary retail outlets are located within a 400-mile radius of the distribution center. These retail outlets receive the order from ZBC within 2 days after notifying the distribution center, provided that the stock is available. However, if an order is not fulfilled by the company, no backorder is placed; the retailers arrange to get their shipment from other distributors, and ZBC loses that amount of business.

**Continued...**

The company distributes a wide variety of bicycles. The most popular model, and the major source of revenue to the company, is the AirWing. ZBC receives all the models from a single manufacturer in China, and shipment takes as long as 4 weeks from the time an order is placed. With the cost of communication, paperwork, and customs clearance included, ZBC estimates that each time an order is placed, it incurs a cost of $65. The purchase price paid by ZBC, per bicycle, is roughly 60% of the suggested retail price for all the styles available, and the inventory carrying cost is 1% per month (12% per year) of the purchase price paid by ZBC. The retail price (paid by the customers) for the AirWing is $170 per bicycle.

ZBC is interested in making an inventory plan for 2013. The firm wants to maintain a 95% service level (i.e., $Z$ value of 1.645) with its customers to minimize the losses on the lost orders. The data collected for the past 2 years are summarized in the preceding table. A forecast for AirWing model sales in 2013 has been developed and will be used to make an inventory plan for ZBC.

| MONTH | 2011 | 2011 | FORECAST FOR 2013 |
|---|---|---|---|
| January | 6 | 7 | 8 |
| February | 12 | 14 | 15 |
| March | 24 | 27 | 31 |
| April | 46 | 53 | 59 |
| May | 75 | 86 | 97 |
| June | 47 | 54 | 60 |
| July | 30 | 34 | 39 |
| August | 18 | 21 | 24 |
| September | 13 | 15 | 16 |
| October | 12 | 13 | 15 |
| November | 22 | 25 | 28 |
| December | 38 | 42 | 47 |
| Total | 343 | 391 | 439 |

**Required:**

(a) Develop an inventory plan to help ZBC.

[8 Marks]

(b) Determine the reorder points (ROPs) and total costs.

[7 Marks]

(c) How can you address demand that is not at the level of the planning horizon?

[5 Marks]

**Continued...**

## QUESTION 4

(a) Auto pistons at Wemming Chung's plant in Shanghai are produced in a forging process, and the diameter is a critical factor that must be controlled. From sample sizes of 10 pistons produced each day, the mean and the range of this diameter have been as follows:

| DAY | MEAN (mm) | RANGE (mm) |
|---|---|---|
| 1 | 156.9 | 4.2 |
| 2 | 153.2 | 4.6 |
| 3 | 153.6 | 4.1 |
| 4 | 155.5 | 5.0 |
| 5 | 156.6 | 4.5 |

(i) What are the UCL$x$ and LCL$x$, using 3σ? Plot the data.

[5 Marks]

(ii) What are the $UCL_R$ and $LCL_R$, using 3σ? Plot the data.

[5 Marks]

(iii) If the true diameter mean should be 155 mm and you want this as your center (nominal) line, what are the new UCL$x$ and LCL$x$?

[4 Marks]

(b) Philip Crosby said that quality is free. Why?

[6 Marks]

## QUESTION 5

(a) The make-or-buy decision covers various alternatives and is not simply limited to making or buying. There is a relatively broad range of alternative possibilities, among which the following are worth highlighting: producing internally without investment, producing internally with investment, integrating (vertically or horizontally), partially integrating, quasi-integrating (developing partnerships or strategic alliances, licensing, franchising), outsourcing, and divesting. Discuss how outsourcing and vertical integration are related? Can a single firm successfully do both?

[10 Marks]

**Continued...**

(b) Chau Wing has a repetitive manufacturing plant producing automobile steering wheels. Use the following data to prepare for a reduced lot size. The firm uses a work year of 305 days.

| | |
|---|---|
| Annual demand for steering wheels | 30500 |
| Daily demand | 100 |
| Daily production (8 hours) | 800 |
| Desired lot size (2 hours of production) | 200 |
| Holding cost per unit per year | RM100 |

(i) What is the setup cost, based on the desired lot size?

[5 Marks]

(ii) What is the setup time, based on $40 per hour setup labor?

[5 Marks]

**Formulas**

$$Q^* = \sqrt{\frac{2DS}{H}}$$

95% service level has a $Z$ value of 1.645

$$\sigma = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}}$$

$$SS = Z\,(\sigma)$$

$$ROP = \mu + Z\,(\sigma)$$

$$Total\ inventory\ cost = \frac{1}{2}\,Q^*(H) + SS(H) + \frac{D}{Q^*}\,(S)$$

$$UCL_{\bar{x}} = \bar{\bar{X}} + A_2\bar{R};\quad A_2 = 0.308$$

$$LCL_{\bar{x}} = \bar{\bar{X}} - A_2\bar{R};\quad A_2 = 0.308$$

$$UCL_R = D_4\bar{R};\quad D_4 = 1.777$$

$$LCL_R = D_3\bar{R};\quad D_3 = 0.223$$

$$S\,(for\ Lot\ size) = \frac{Q^2 * H * \left(1 - \frac{d}{p}\right)}{2D}$$

**End of Page**